

On-Orbit Spectral Characterization Results for Terra MODIS Reflective Solar Bands

Nianzeng Che^a, Xiaoxiong (Jack) Xiong^{*b}, and Williams Barnes^c

^aScience Systems and Applications, Inc., 10210 Greenbelt Road, Suite 600, Lanham, MD 20706;

^bLaboratory for Terrestrial Physics, NASA/GSFC, Greenbelt, MD 20771;

^cJCET, University of Maryland, Baltimore County, 1000 Hilltop Circle, Baltimore, MD 21250

ABSTRACT

The MODIS Protoflight Model (PFM), launched onboard the NASA's Earth Observing System (EOS) Terra spacecraft, has been in operation for more than three years. In addition to constant radiometric calibration activities, the sensor's on-orbit spectral bandpasses of the reflective solar bands (RSBs) with wavelengths from 0.41 to 2.2 micrometers have been measured (every three months) using the on-board Spectral Radiometric Calibration Assembly (SRCA). The spectral characteristics of the SRCA were calibrated pre-launch using the Spectral Measurement Assembly (SpMA). The MODIS on-orbit spectral characterization using the SRCA has been performing as designed and the key spectral parameters, with few exceptions, are well within the specification limits. This paper provides a brief review of the MODIS prelaunch spectral characterization. It focuses on the Terra MODIS instrument's on-orbit spectral characterization activities, trending results, and comparisons with pre-launch characterizations and the specifications.

Keywords: MODIS, radiometer, reflective solar bands, calibration, spectral, SRCA

1. INTRODUCTION

The MODerate Resolution Imaging Spectroradiometer (MODIS) has 36 spectral bands distributed on four focal planes with wavelengths ranging from 0.41 to 14.5 micrometers and spatial resolutions of 250m, 500m, and 1.0km at the instrument nadir. The MODIS is a cross-track scanning radiometer operated in a Sun-synchronous near polar orbit at an altitude of 705km using a two-sided paddle-wheel scan mirror, making observations over a wide field of view (FOV) of $\sim 55^\circ$ from the instrument nadir. The scan mirror continuously rotates, producing each scan (1.478s) a swath of 2330km along scan by 10km (at nadir) along track. The MODIS Protoflight Model (PFM) was launched onboard the NASA's Earth Observing System (EOS) Terra spacecraft on December 18, 1999 in a descending (southwards) orbit with a local equatorial crossing time of 10:30am. The MODIS PFM has been in operation for more than three years, continuously providing users with calibrated data sets. Consequently many science products have been developed for various studies of global environmental changes over time.

The MODIS on-orbit radiometric calibration of the 20 reflective solar bands (1-19 and 26) is achieved by a solar diffuser (SD) and solar diffuser stability monitor (SDSM) system and of the 16 thermal emissive bands (20-25 and 27-36) by a v-grooved blackbody (BB). Detailed descriptions of the MODIS instrument and its on-orbit calibration and characterization have been reported in a number of references¹⁻⁵. This paper focuses on the MODIS instrument's on-orbit spectral characterization of its reflective solar bands (RSB) using the on-board Spectral Radiometric Calibration Assembly (SRCA). The spectral response stability of the sensor is directly related to its radiometric calibration accuracy and science data products quality. Therefore the ability of either directly or indirectly tracking the sensor's on-orbit spectral performance is of great importance. In this paper, we describe Terra MODIS on-orbit spectral characterization activities and results from over three years of measurements and demonstrate that the SRCA has been performing as designed. With few exceptions all the key spectral parameters, such as the relative spectral response and spectral band center wavelength shifts, are well within the specification limits.

*Xiaoxiong.Xiong-1@nasa.gov